

*Clemson University*



# Clemson University Advanced Microscopy for Naval Ship Hull Protection

## **Requested Action**

Clemson is requesting \$1.6 million to support the purchase of a new microscope and associated equipment which will assist efforts to innovate and develop new and highly effective maritime materials that will protect optical sensors and U.S. naval surface ships and submarines from the costly consequences of marine corrosion and biofouling.

## **Identified Need**

Since the dawn of the maritime history fouling of ship hulls by barnacles has been the bane of every mariner at sea. Even today, millions of dollars are spent to remove barnacles from ships. For a marine vessel, biofouling occurs on virtually any submerged surface in the sea, from ship hulls to oil rigs, dock pilings and nuclear submarines, and leads to high frictional resistance causing reduction in speed and loss of maneuverability. To offset these effects fuel consumption can increase up to 40% causing up to 77% in increased operating costs.

This project will improve fleet readiness and reliability and reduce both operational and maintenance costs for marine vessels. In addition to furthering these research efforts, the microscope will improve graduate and undergraduate microscopy education at Clemson University; both will help South Carolina create new jobs in a knowledge-based economy.

The Okeanos Marine Research Laboratory located in the Department of Biological Sciences at Clemson University seeks to innovate and develop new and highly effective maritime materials that will protect optical sensors and U.S. naval surface ships and submarines from the costly consequences of marine corrosion and biofouling. To accomplish this goal, the lab will build on its expertise and advance fundamental knowledge about biofouling and corrosion biological mechanisms by conducting cellular biology, genomics and polymer chemistry multidisciplinary research projects.

## **Expected Outcome**

To date, this approach has resulted in two patent-pending maritime material science innovations: (1) working with the U.S. Office of Naval Research (ONR) to investigate the cell biology of biofouling marine invertebrates; and (2) working with the University of Dayton Research Institute, which received support from the Air Force Office of Scientific Research (AFOSR) to investigate a biological alternative to replace the use of toxic chromium anti-corrosion coatings on aircraft components.

The Okeanos laboratory is currently developing a collaboration with the NAVASEA UnderSea Warfare Center at Newport, Rhode Island and the Center for Excellence in Undersea Technologies (COEUT) at the University of Rhode Island Graduate School in Oceanography to develop safe, green and biologically relevant anti-corrosion and anti-fouling materials and coatings that will be highly effective and perform at the operating depths of our nations naval nuclear submarine force. This research will involve investigations of the genomic biodiversity of biofouling communities and testing of novel materials and coatings in the depths of the sea.